Feb. 26, 1957 H. S. JENCKS 2,783,443

CONNECTOR PLUG ASSEMBLY

Filed Sept. 29, 1954 2 Sheets-Sheet 1

Fig. 1

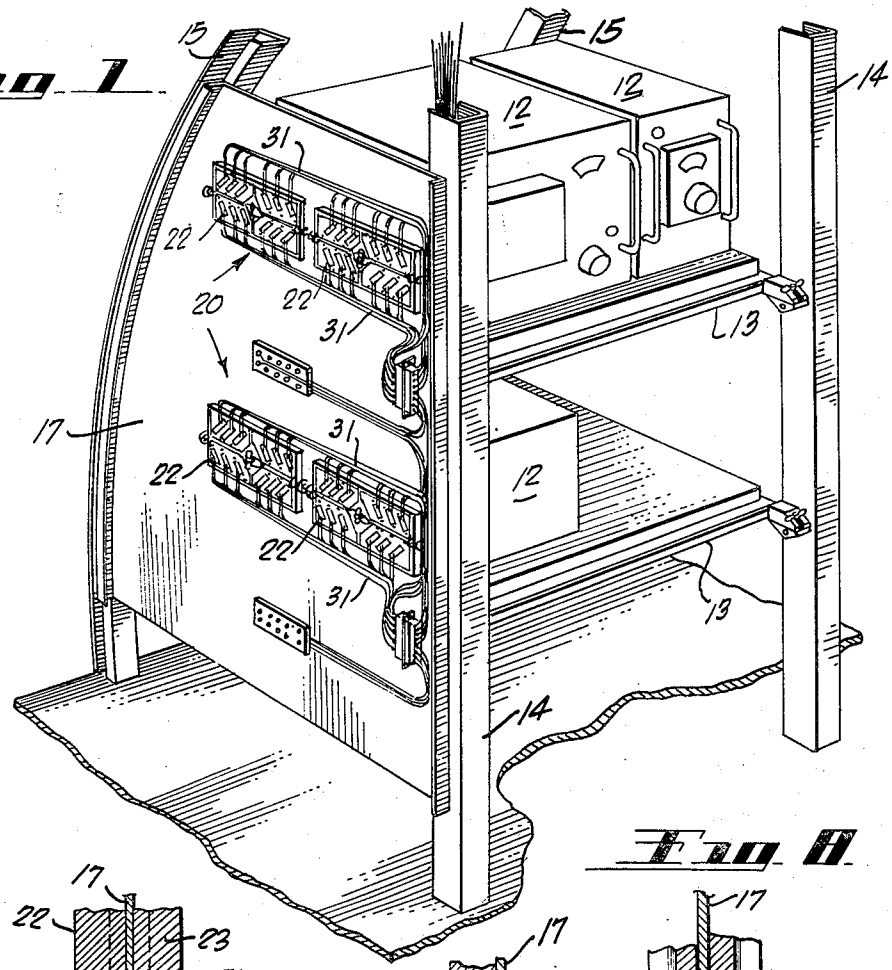
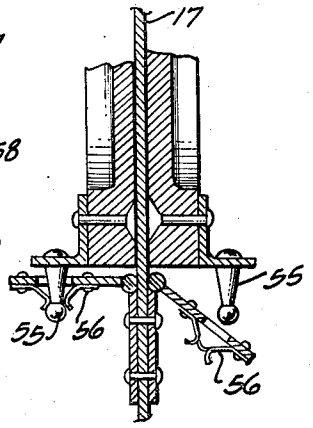


Fig. 8



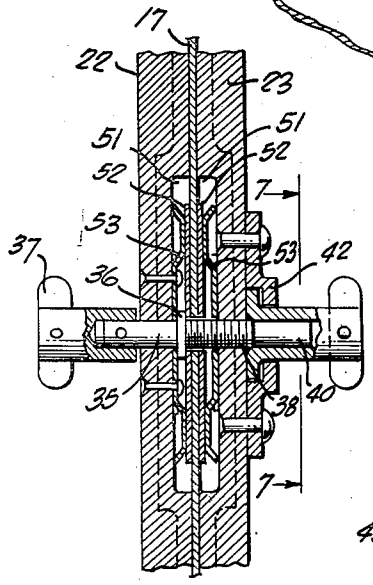


Fig. 9

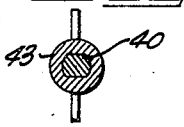


Fig. 6

Fig. 7

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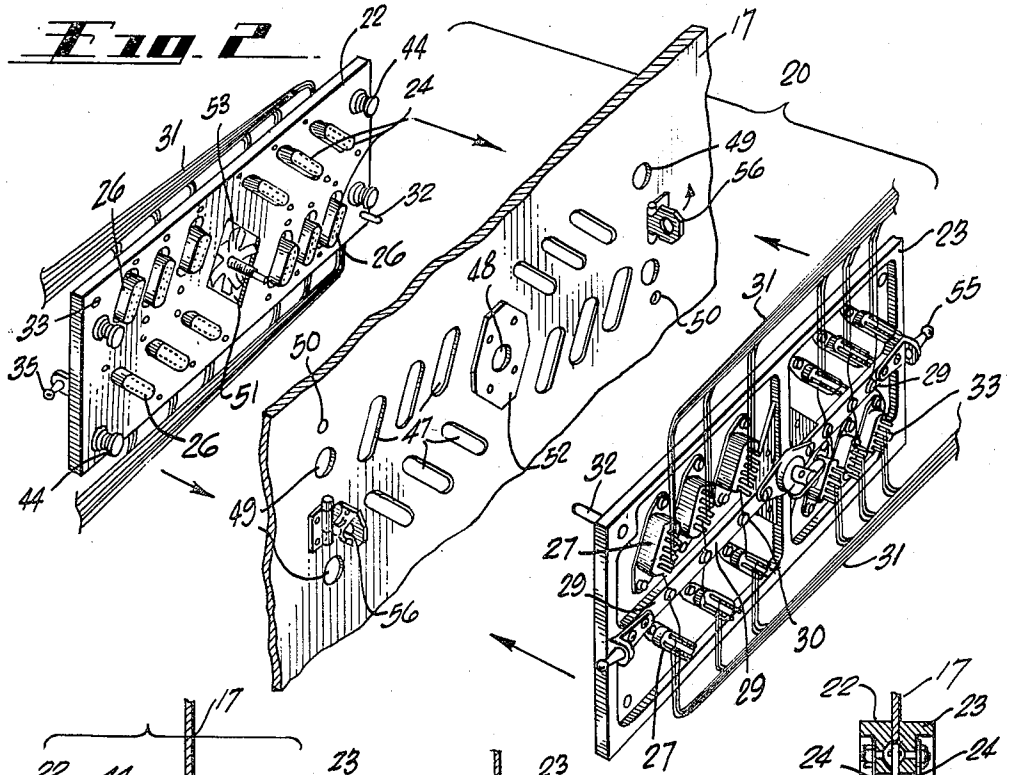
FIG. 2



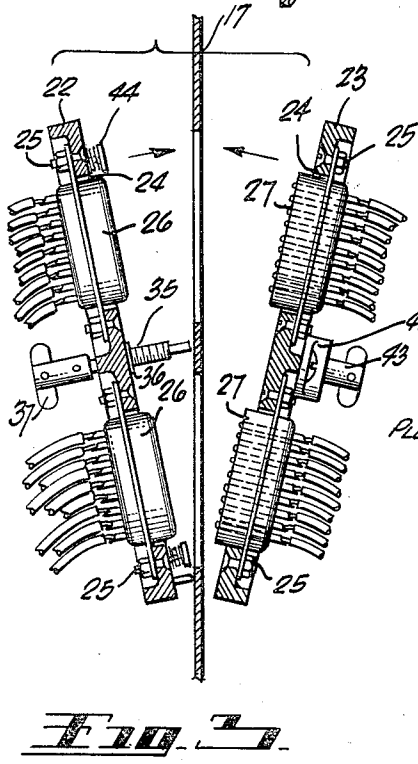


FIG. 3

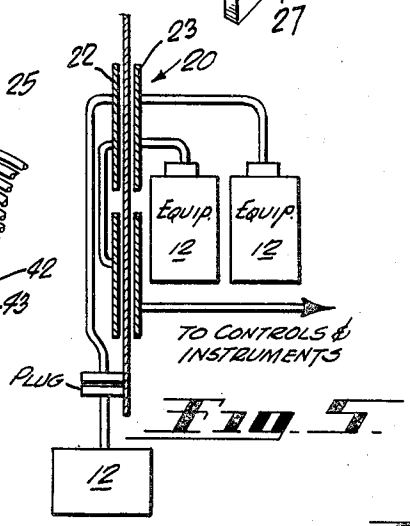


FIG. 5

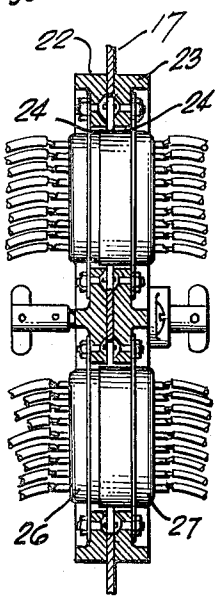


FIG. 4

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CONNECTOR PLUG ASSEMBLY

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Application September 29, 1954, Serial No. 459,008

12 Claims. (Cl. 339—126)

This invention relates to electrical connectors and more particularly to connectors of the panel type which are readily separable.

It is here contemplated to provide a pair of mating connectors of the master or panel type which afford a separable, multi-path connection through a partition or bulkhead in a vehicle body or other structural unit. In addition to the connection through the partition, as it is the frequent practice to ground several paths to the body through the panel of the connector, a unique arrangement is incorporated in the faces of the panels which insures a good electrical contact between the panels and the partition which is not affected by shock or vibration.

While heretofore many various two part constructions have been proposed in which the separable connector parts are arranged on opposite sides of a partition and have mating contacts extending therethrough, each of these constructions has required, during coupling or uncoupling, that access be had simultaneously to both parts. Such access was necessary either for the purpose of manipulation or to prevent the parts from falling and causing damage thereto. In the construction here embodied this necessity is obviated by independently supporting each of the connector parts on the partition and further providing means by which the parts may be released from coupled relation from either side of the partition.

By the foregoing arrangement, the initial assembly of electrical instruments and the provision of permanent wiring leading to remotely located controls and indicators may be performed in different stages whereby mass production procedures are greatly facilitated. Furthermore, since frequent bench tests are performed on the electrical instruments, it is of prime importance that removal and replacement be easily and rapidly accomplished. The present invention enables such operations to be so performed even by those having little or no knowledge in the electrical field.

Other features and advantages of the present invention will be hereinafter apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a perspective view showing the present invention applied to an electrical installation;

Figure 2 is a perspective view showing the invention in aligned but uncoupled relation;

Figure 3 is a side sectional view of the invention in uncoupled relation;

Figure 4 is a view similar to Figure 3 but showing the parts coupled;

Figure 5 is a diagrammatic showing of a portion of the installation of Figure 1;

Figure 6 is an enlarged fragmentary sectional view of the coupling securing and grounding means;

Figure 7 is a cross-sectional view taken along line 7—7 in Figure 6;

Figure 8 is an enlarged fragmentary sectional view of the latch means associated with the coupling; and

Figure 9 is an enlarged sectional view showing a modified form of coupling securing means.

Referring now to the drawing, and particularly to Figure 1, there is shown a set of electrical instrumentalities 12, which, by way of example, may be a radio transmitter or receiver, movable outwardly in the direction indicated and being supported on trays or shelves 13 which in turn are suitably attached to hollow uprights 14 and 15. Extending laterally between two of the uprights 14 and 15 is a metallic plate-like partition or bulkhead 17 through which electrical connections with the instrumentalities 12 are made by means of separable mating connectors designated generally at 20. While the detailed construction of the connectors 20 is hereinafter more fully defined, for the present it is sufficient that it be understood that the connectors 20 each comprises a pair of coupling parts respectively positioned on opposed surfaces of partition 17 and having mating contacts in respective engagement through the partition 17. By the arrangement of various means employed for holding the coupling parts mutually engaged and each independently supported in position on the partition, it will be seen that either coupling part of any connector 20 may be released from engagement and removed from supported position and yet not require that access be had to the other coupling part.

The connector 20, referring particularly to Figures 2 through 8, consists of two panel-type boards 22, 23 of like shape and size. In and through each board 22, 23 are formed a series of rows of openings 24, here shown as being oblong in form and having their major axes disposed at an acute angle to the edges of the boards 22, 23, with the respective openings 24 in one board aligned with the openings 24 in the other board. Within each opening 24 of the panel 22 there is affixed as by screws 25, a plural prong type receptacle 26 of conventional construction and within each opening 24 of panel 23 is affixed a plural prong plug 27 adapted for mating engagement with the receptacle 26. Situated on a rib 29 formed integrally on the back of each of the boards 22, 23 are suitably positioned a series of ground terminals 30. For convenience in attaching ground wire lead-ins there is shown one ground terminal 30 for each column of receptacles 26 and plugs 27. While the angle of inclination of the receptacles 26 and plugs 27 may be varied as desired, it has been found that the approximate angle, shown in the two column arrangement herein, provides for the optimum panel configuration and facilitates the ease and neatness of the connections from the lead-in strands 31 to the terminals of the various connectors. In order to properly align and position the mating receptacles 26 and plugs prior to their electrical engagement each panel 22, 23 is provided with a guide pin 32 and guide opening 33, the pin 32 and opening 33 on one board being arranged for mutual and respective engagement with the opening 33 and pin 32 on the other board.

While in many applications the frictional engagement between the receptacles 26 and plugs 27 is adequate to maintain them in engaged relation, when the connection is subjected to excessive vibration, as by reason of being mounted in a moving vehicle such as an aircraft, it is mandatory that a more positive means be incorporated in the construction to prevent separation. To this end the panels 22, 23 are equipped with screw threaded locking means which, in one form of the invention as best shown in Figure 6, includes a screw threaded stud 35 rotatably but non-removably passing through the central portion of the panel 22. Stud 35 is non-removably maintained in the panel 22 by virtue of a collar 36 and a wing-type turning member 37 which respectively project radially from the stud 35 on opposite sides of panel 22. The screw threaded portion of stud 35 is adapted to extend into a correspondingly threaded bore 38 in the panel 23. For a purpose

hereinafter made apparent, a non-circular extension 40 on the stud 35 is adapted to pass through bore 38 and protrude from the surface of the panel 23. To the back side of the panel 23 there is rotatably attached, by retaining plate 42, a key member 43 with a socket of non-circular cross section for embracingly receiving the extension 40 of the stud 35. By the foregoing arrangement the stud 35 can be rotated into or out of threaded engagement with bore 38 from either side of the connector 20.

For ease in separating the parts during an uncoupling operation to overcome the appreciable frictional forces inherent in multiple plug-prong type connectors, one of the panels, here shown as panel 22, has attached thereto a series of spring pressed eject buttons 44 adapted to abut the surface of the other panel and yieldingly urge the connector parts out of engagement. The positioning of the eject buttons 44 is optional but should be properly selected to cause simultaneous separation of all parts and prevent the canting of panel 22 with respect to panel 23. Additionally the combined force exerted by the springs when compressed should be adequate to overcome the friction between receptacles 26 and plugs 27 and not require manipulation by the individual disconnecting the parts.

As best viewed in Figure 2, the connectors 20 are here utilized to afford an electrical connection through sheet metal partition 17. To enable the carrying out of this purpose, in partition 17 there are suitably formed series of passages or openings 47 having an appropriate configuration and arrangement to enable each and all of the receptacles 26 and the plugs 27 to freely enter therein into mutual mating engagement. There are additional openings 48, 49 and 50 in the partition 17 to respectively permit stud 35, eject buttons 44 and guide pins 32 to pass therethrough to perform their respective functions.

In accordance with usual practice the chassis of the vehicle or other support, in which electrical equipment is installed, serves as a common ground. In the present showing partition 17 is a part of the grounding chassis and must therefore be in circuit with ground terminals 30 on connectors 20. The certainty of good contact between panels 22, 23 and partition 17 is assured by the arrangement best shown in Figure 6. On opposing surfaces of panel 17 there are firmly attached, as by riveting, plates 52 of copper or other good conductive material. The plates 52 are shown (Fig. 2) to be octagonal in configuration and disposed about opening 48 with an aperture in each in registry with opening 48. Disposed in a similar position in a recess 51 in each of the panels 22, 23 is a multi-fingered resilient contact member 53, each of which is disposed to contact the plate 52 on its respective side of the partition 17. When the panels 22, 23 are firmly drawn together by the screw connection therebetween, the spring pressure of the resilient contacts 53 assures a good connection substantially unaffected by vibration. While the precise location of the ground connection could be varied, it is best located as shown, that is, immediately at or about the point of application of the force exerted by the connector locking means 35, 38.

Another feature of the invention, referring now to Figure 8, includes the means by which each of the panels 22, 23 is independently removably maintained in supported position against partition 17. The means by which each panel is supported comprises pairs of quick detachable fasteners consisting of laterally extending fingers 55 rigidly attached to opposite extremities of each of panels 22, 23 and resilient sockets 56 pivotally attached by hinges to both sides of partition 17 and adapted to receive the extremities of fingers 55 therein. Regardless of the presence of the other connector part, either panel 22 or 23 may be oriented with its individual contacts in the partition openings 47. Then, by latching sockets 56 over fingers 55 on the panel, the panel will be securely kept in its proper position. The utility of this feature will hereinafter become more apparent.

In another form of the invention shown in Figure 9 an alternate means is provided which serves the combined function of supporting the panels 22, 23 independently of each other and firmly maintaining the coupling parts in mutual engagement. This form of the invention embodies a stud 58, threaded from end to end, positioned midway of its length through opening 48 in partition 17 and is non-rotatably secured therein by means of opposed nuts 59. For cooperation with opposite extremities of stud 58 each of panels 22, 23 is equipped with a screw threaded key 60 rotatably attached to the back thereof by means of a keeper plate 42 in a manner similar to the attachment of socketed key 43 in the other form of the invention. By the employment of this construction the necessity of the quick detachable fastener 55, 56 is eliminated. While the ground contact plate and resilient finger arrangement utilized in the other form of the invention is not shown in conjunction with Figure 9, it is to be understood that such provision could be made in the same manner and by the same means as depicted in Figure 6.

Now considering the installation shown in Figure 1 in conjunction with the diagram of Figure 5, the wires brought in through upright post 14 are assembled as a permanent part of the structure, such as a vehicle, and lead to a remote point to controls and instruments for equipment 12. At a separate assembly point, conductors from equipment 12 can be attached to the various contacts on one part of connector 20. Likewise the parts of connectors 20 to be attached to the side of partition 17 on the side remote from equipment 12 can be prewired in a manner to accommodate the desired circuits to be established. The prewired panels 22, 23 are subsequently attached to partition 17 in any sequence and regardless of the presence or absence of the respective mating coupling parts. This feature is accomplished by virtue of the self-supporting character of each panel 22, 23 effected by means of fingers 55 and sockets 56. Also any pair of couplings parts, constituting a single connector 20, may be locked or latched together, by the threaded stud 35 or 58, from either side of partition 17. Conversely, in the event equipment 12 requires repair or is to be replaced, it may be removed from shelf 13 and its connector part uncoupled without requiring access to the coupling part on the opposite side of partition 17. Also to alter the circuity of the system or to repair the connections to the contacts on the panel 22, it may be uncoupled without necessitating the removal of equipment 12 which, in the position shown, prevents access to the coupling part on its side of bulkhead 17.

While the preferred embodiments of the invention are shown herein, it is to be understood that the invention is susceptible of changes within the scope of the appended claims.

I claim:

1. A connector of the type described comprising: a plate-like supporting member with apertures therein; a pair of connector parts having mating contacts, said parts being adapted to be brought into mating engagement with the contacts passing through said member from opposite sides into mutual contact; unitary securing means to maintain the connector parts in coupled relation; and means on each connector part independently operable to release the securing means whereby the connector may be uncoupled from either of the opposite sides of the supporting member.

2. A connector as defined in claim 1 and including releasable fastening means on each connector part for securing the parts independently of each other to the partition whereby when the parts are uncoupled and one part removed, the other will be maintained in secured position.

3. A construction of the type described comprising: a partition forming a support and having a plurality of apertures therein; first and second panel type connector members each having a plurality of mutually engaging contact

parts, said connector members being adapted to be supported on opposite sides of said partition with the contacts extending through the apertures in the partition into mutual engagement; a unitary coupling securing means for maintaining the connectors in coupled relation; means on each of the connector members for releasing the securing means; and quick detachable fastener means for independently supporting each of the connector members on the partition.

4. A connector of the type described comprising: a partition having apertures therein; first and second panel type coupling parts each having contacts adapted to be brought into mating relation through the apertures in the panel; a screw threaded stud in the first coupling part; a threaded bore in the second coupling part for engagement by the stud to secure the parts in coupled relation; a non-circular extension on the stud adapted to pass through and beyond the threaded bore; a socket member for embracingly receiving the non-circular extension; means for rotatably securing the socketed member on the second coupling parts in alignment with the threaded bore; and means for rotating the stud and socketed member whereby the parts may be released from secured relation from either side of the partition.

5. A connector as defined in claim 4 and having quick detachable fastener means for independently supporting the coupling parts on the partition in alignment with the apertures therein.

6. A connector of the type defined comprising: a grounded partition; panel type connector parts adapted to respectively lie in facewise engagement with the partition and having contacts passing through the partition into mating engagement; resilient ground contacts on each of the connector parts adapted to engage the partition; securing means exerting a force maintaining the parts in coupled relation, said force being exerted at a point proximate the ground contacts.

7. A connector of the type described comprising: a support partition having apertures therein; hinged resilient socket means attached to the partition on opposite sides thereof; multi-contact panel type connector parts adapted to respectively lie on opposite sides of the partition and mate in coupled relation through the apertures; and finger means extending from each of the connector parts and adapted to be received by the socket means to maintain the parts in supported relation to the partition.

8. A connector of the type described comprising: a support partition having apertures therein; socket means attached to the partition on opposite sides thereof; multi-contact panel type connector parts adapted to respectively lie on opposite sides of the partition and mate in coupled relation through the apertures; and finger means extending from each of the connector parts and adapted to be received by the socket means to maintain the parts in supported relation to the partition.

9. A connector of the type described comprising: first and second panel type connector parts, each of said parts having a plurality of contact receiving openings therein, the openings in the first connector part and the openings in the second connector part constituting similar patterns; a multi-prong plug removably mounted in, and insulated from, each opening in the first connector part; a multi prong receptacle removably mounted in, and insulated from, each opening in the second connector part, the plugs and receptacles being adapted to matingly engage; guide means coacting between the first and second parts to align the plugs and receptacles with each other; a plurality of ground terminals on each of the connector parts in proximity to the openings therein; a multi fingered resilient ground contact on each of said connector parts; a screw threaded stud rotatably mounted in one of said connector parts and having a non-circular end projection; the other of said connector parts have a threaded bore to engage the threaded stud, the non-circular extension being adapted to pass through and project beyond the other of said connector parts; a socketed member rotatably secured on the other of said connector parts and adapted to engage about the non-circular extension; means for rotating each said stud and said socketed member; a grounded partition adapted to be disposed in contact with the ground contacts and between the connector parts when in mating engagement, said partition having a plurality of openings therein through which the plugs, receptacles, guide means, and stud are respectively adapted to pass; a plate of low resistance material mechanically and electrically secured to each of the opposite sides of the partition and adapted to be engaged by the respective ground contacts; an arm projecting from opposite extremities of each of the panel type connector parts; and hinged resilient clasps attached to the partition, each of said clasps being adapted to receive one of said arms to form therewith a quick detachable fastener whereby each of said panels is removably maintained in position on the partition.

10. A connector of the type described comprising: first and second panel type connector parts, each of said parts having a plurality of contact receiving openings therein, the openings in the first connector part and the openings in the second connector part constituting aligned patterns; a multi prong plug removably mounted in, and insulated from, each opening in the first connector part; a multi prong receptacle removably mounted in, and insulated from, each opening in the second connector part, the plugs and receptacles being adapted to matingly engage; guide means coacting between the first and second parts to align the plugs and receptacles with each other; ground terminal means on each of the connector parts, a resilient ground contact on each of said connector parts; a screw threaded stud rotatably mounted in one of said connector parts and having a non-circular end projection, the other of said connector parts have a threaded bore to engage the threaded stud, the non-circular extension being adapted to pass through and project beyond the other of said connector parts; a socketed member rotatably secured on the other of said connector parts and adapted to engage about the non-circular extension; means for rotating each said stud and said socketed member; a grounded partition adapted to be disposed between and contacted by the resilient contacts of the connector parts when in mating engagement, said partition having a plurality of openings therein through which the plugs, receptacles, guide means, and stud are respectively adapted to pass; projections extending from opposite extremities of each of the panel type connector parts; and hinged resilient clasps attached to the partition, each of said clasps being adapted to receive one of said projections to form therewith a quick detachable fastener whereby each of said panels is removably maintained in position on the partition.

11. A connector of the type described comprising: first and second panel type mating connector parts, each of said parts having a plurality of matched contact receiving openings therein, a multi prong plug removably mounted in and insulated from each opening in the first connector part; a multi prong receptacle removably mounted in and insulated from each opening in the second connector part, the plugs and receptacles being adapted to matingly engage; a plurality of ground terminals on each of the connector parts in proximity to the openings therein; a multi fingered resilient ground contact on each of said connector parts; a screw threaded stud rotatably mounted in one of said connector parts and having a non-circular end projection, the other of said connector parts have a threaded bore to engage the threaded stud, the non-circular extension being adapted to pass through and project beyond the other of said connector parts; a socketed member rotatably secured on the other of said connector parts

and adapted to engage about the non-circular extension; means for rotating said stud and said socketed member; a grounded partition adapted to be disposed between the connector parts when in mating engagement, said partition having a plurality of openings therein through which the plugs, receptacles, and stud are respectively adapted to pass; a plate of low resistance material mechanically and electrically secured to each of the opposite sides of the partition and adapted to be engaged by the respective ground contacts; arms projecting from opposite extremities of each of the panel type connector parts; and hinged resilient clasps attached to the partition, each of said clasps being adapted to receive one of said arms to form therewith a quick detachable fastener whereby each of said panels is removably maintained in position on the partition.

12. A connector of the type described comprising: first and second panel type mating connector parts, each of said parts having a plurality of similarly positioned contact receiving openings therein; a multi prong plug removably mounted in and insulated from each opening in the first connector part; a multi prong receptacle removably mounted in and insulated from each opening in the second connector part, the plugs and receptacles being adapted to matingly engage; a plurality of ground terminals on each of the connector parts in proximity to the openings therein; a multi fingered resilient ground contact on each of said

connector parts; a screw threaded stud rotatably mounted in one of said connector parts and having a non-circular end projection, the other of said connector parts have a threaded bore to engage the threaded stud, the non-circular extension being adapted to pass through and project beyond the other of said connector parts; a socketed member rotatably secured on the other of said connector parts and adapted to engage about the non-circular extension; means for rotating said stud and said socketed member; a grounded partition adapted to be disposed between and engaged by the ground contacts on the connector parts when in mating engagement, said partition having a plurality of openings therein through which the plugs, receptacles, and stud are respectively adapted to pass; an arm projecting from opposite extremities of each of the panel type connector parts; and hinged resilient clasps attached to the partition, each of said clasps being adapted to receive one of said arms to form therewith a quick detachable fastener whereby each of said panels is removably maintained in position on the partition.

References Cited in the file of this patent

UNITED STATES PATENTS

2,466,370	Burtt	Apr. 5, 1949
2,532,538	Burtt et al.	Dec. 5, 1950
2,647,244	Dewey et al.	July 28, 1953